

WHAT IS CLAIMED IS:

1. A method for concentrating microorganisms from a biological sample, wherein said method comprises the steps of:
 - (a) adding a sample containing microorganisms to an ultracentrifuge tube and
 - (b) centrifuging said sample in said tube to concentrate said microorganisms, said ultracentrifuge tube comprising an upper region, a middle region and a lower region, wherein an inner diameter of said upper region is larger than an inner diameter of said lower region, wherein said upper region is separated from said lower region by said middle region having a decreasing diameter from said upper region toward said lower region and wherein said lower region has a closed bottom.
2. The ultracentrifuge tube of claim 1, wherein said middle region comprises one or more serrations.
3. The ultracentrifuge tube of claim 1, wherein said lower region has an inner diameter small enough to trap an air bubble between two layers of liquid such that the air bubble will keep said two layers of liquid separate so long as said centrifuge tube is at rest.
4. The ultracentrifuge tube of claim 1, wherein said inner diameter of said lower region is smaller than 0.25 inch.
5. The ultracentrifuge tube of claim 1, wherein said lower region is at least 5% of the total length of said tube.
6. The ultracentrifuge tube of claim 1, wherein the inner surfaces are polished by vapor polishing.
7. The ultracentrifuge tube of claim 1, wherein the inner surfaces are coated with adhering polymer to prevent adsorption of biological particles.

8. The method of claim 1 wherein said centrifuge tube is prepared from materials such that said tube can be centrifuged at velocities high enough to band mycoplasmas in CsCl gradients without said centrifuge tube breaking.
9. The ultracentrifuge tube of claim 1, wherein said tube is prepared from materials such that said tube can be centrifuged at velocities high enough to band viruses in CsCl gradients without said tube breaking.
10. The ultracentrifuge tube of claim 1, wherein said tube is made of polycarbonate.
11. The ultracentrifuge tube of claim 1, wherein said upper region, middle region and lower region have outer diameters equal to each other.
12. The ultracentrifuge tube of claim 1, wherein said upper region has an outer diameter larger than an outer diameter of said lower region.
13. The ultracentrifuge tube of claim 1, wherein said inner diameter of said lower region is smaller than 0.1 inch.
14. The ultracentrifuge tube of claim 1, wherein said inner diameter of said lower region is in the range 0.08 - 0.1 inch.
15. The ultracentrifuge tube of claim 1, wherein said inner diameter of said lower region is in the range 0.039 - 0.08 inch.
16. The ultracentrifuge tube of claim 1, wherein said inner diameter of said lower region is 0.064 inch.
17. The method of claim 1, wherein said microorganisms band in said lower region.
18. The method of claim 17 further comprising a step of recovering said microorganisms from said lower region.

19. A method for concentrating microorganisms from a biological sample, wherein said method comprises the steps of:

(a) adding a sample containing microorganisms to an ultracentrifuge tube and

(b) centrifuging said sample in said tube to concentrate said microorganisms, said ultracentrifuge tube comprising an upper region, a middle region and a lower region, wherein an inner diameter of said upper region is larger than an inner diameter of said lower region, wherein said upper region is separated from said lower region by said middle region having a decreasing diameter from said upper region toward said lower region and wherein said lower region has a closed bottom.

20. The ultracentrifuge tube of claim 19, wherein said middle region comprises one or more serrations.
21. The ultracentrifuge tube of claim 19, wherein said lower region has an inner diameter small enough to trap an air bubble between two layers of liquid such that the air bubble will keep said two layers of liquid separate so long as said centrifuge tube is at rest.
22. The ultracentrifuge tube of claim 19, wherein said inner diameter of said lower region is smaller than 0.25 inch.
23. The ultracentrifuge tube of claim 19, wherein said lower region is at least 5% of the total length of said tube.
24. The ultracentrifuge tube of claim 19, wherein the inner surfaces are polished by vapor polishing.
25. The ultracentrifuge tube of claim 19, wherein the inner surfaces are coated with adhering polymer to prevent adsorption of biological particles.
26. The method of claim 19, wherein said centrifuge tube is prepared from materials such that said tube can be centrifuged at velocities high enough to band yeast in CsCl gradients without said centrifuge tube breaking.

27. The method of claim 19, wherein said centrifuge tube is prepared from materials such that said tube can be centrifuged at velocities high enough to band bacteria in CsCl gradients without said centrifuge tube breaking.
28. The ultracentrifuge tube of claim 19, wherein said tube is made of polycarbonate.
29. The ultracentrifuge tube of claim 19, wherein said upper region, middle region and lower region have outer diameters equal to each other.
30. The ultracentrifuge tube of claim 19, wherein said upper region has an outer diameter larger than an outer diameter of said lower region.
31. The ultracentrifuge tube of claim 19, wherein said inner diameter of said lower region is smaller than 0.1 inch.
32. The ultracentrifuge tube of claim 19, wherein said inner diameter of said lower region is in the range 0.08 - 0.1 inch.
33. The ultracentrifuge tube of claim 19, wherein said inner diameter of said lower region is in the range 0.039 - 0.08 inch.
34. The ultracentrifuge tube of claim 19, wherein said inner diameter of said lower region is 0.064 inch.
35. The method of claim 19 wherein said microorganisms band in said lower region.
36. The method of claim 35 further comprising a step of recovering said microorganisms from said lower region.
37. A method for concentrating microorganisms from a biological sample, wherein said method comprises the steps of:
 - (a) adding a sample containing microorganisms to an ultracentrifuge tube and

(b) centrifuging said sample in said tube to concentrate said microorganisms, said ultracentrifuge tube comprising an upper centripetal region having a cylindrical shape, a middle region having a cylindrical shape and a lower centrifugal region having a cylindrical shape, wherein an inner diameter of said upper region is larger than an inner diameter of said lower region, wherein said upper region is separated from said lower region by said middle region having a decreasing diameter from said upper region toward said lower region and wherein said lower region has a closed bottom.

38. The ultracentrifuge tube of claim 37, wherein said middle region comprises one or more serrations.
39. The ultracentrifuge tube of claim 37, wherein said lower region has an inner diameter small enough to trap an air bubble between two layers of liquid such that the air bubble will keep said two layers of liquid separate so long as said centrifuge tube is at rest.
40. The method of claim 37, wherein said lower region is at least 5% of the total length of said tube.
41. The method of claim 37, wherein said inner diameter of said lower region is smaller than 0.25 inch.
42. The method of claim 37, wherein the inner surfaces are polished by vapor polishing.
43. The method of claim 37, wherein the inner surfaces are coated with an adhering polymer to prevent adhesion of biological particles to the inner surfaces of the tube.
44. The method of claim 37, wherein said inner diameter of said lower region is smaller than 0.1 inch.
45. The method of claim 37, wherein said inner diameter of said lower region is in the range 0.08 - 0.1 inch.

46. The method of claim 37, wherein said inner diameter of said lower region is in the range 0.039 - 0.08 inch.
47. The method of claim 37, wherein said inner diameter of said lower region is 0.064 inch.
48. The method of claim 37, wherein said upper region and said lower region have parallel sides over substantially their entire length.
49. The method of claim 37, wherein said microorganisms band in said lower region.
50. The method of claim 49 further comprising a step of recovering said microorganisms from said lower region.
51. The method of claim 37, wherein at least two different fluids are present, each in different regions and held separately with substantially no diffusion between each before centrifugation.
52. A method for concentrating microorganisms from a biological sample, wherein said method comprises the steps of:
 - (a) adding a sample containing microorganisms to an ultracentrifuge tube and
 - (b) centrifuging said sample in said tube to concentrate said microorganisms, said ultracentrifuge tube comprising an upper region, a middle region and a lower region, wherein an inner diameter of said upper region is larger than an inner diameter of said lower region, wherein said upper region is separated from said lower region by said middle region having a decreasing diameter from said upper region toward said lower region, wherein said lower region has a closed bottom., wherein at least two different fluids are present, each in different regions and held separately with substantially no diffusion between each before centrifugation, wherein said lower region has a sufficiently small bore to hold an air bubble in it with an aqueous solution below it and in the middle region.
53. The method of claim 52 further comprising detecting a band in the lower region, which could not have been detected if the band were in the upper region.

54. The method of claim 1 further comprising detecting a band in the lower region, which could not have been detected if the band were in the upper region.
55. The method of claim 19 further comprising detecting a band in the lower region, which could not have been detected if the band were in the upper region.
56. The method of claim 37 further comprising detecting a band in the lower region, which could not have been detected if the band were in the upper region.

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